

STEREO MOC Status Report  
Time Period: 2016:242 - 2016:248

STEREO Ahead (STA) Status:

1. The following Ground System anomalies/events occurred during this reporting period:

- On day 244, during the DSS-45 support, turbo decoder lock was lost intermittently between 0244z and 0418z. This anomaly resulted in the loss of 158 frames of real-time telemetry and SSR data. See DR# N110380 for more information.
- On day 244, during the DSS-26 support, turbo decoder lock was lost briefly at 1704z and 1715z. These anomalies resulted in the loss of 212 frames of SSR data.
- On day 245, during the DSS-65 support, turbo decoder lock was lost intermittently between 1022z and 1339z. As the maser receiver had been declared red, this support used the XHEMT receiver, which can provide a bit less performance. This anomaly resulted in the loss of 111 frames of real-time telemetry and SSR data. See DR# M109549 and M109550 for more information.
- On day 246, during the DSS-25 support, turbo decoder lock was lost briefly at 1728z. This anomaly resulted in the loss of 1 frame of SSR data.
- On day 247, during the DSS-65 support, turbo decoder lock was lost intermittently between 1354z and 1531z. This anomaly resulted in the loss of 992 frames of real-time telemetry and SSR data. See DR# M109550 for more information.
- On day 247, during the DSS-25 support, turbo decoder lock was lost briefly at 1710z. This anomaly resulted in the loss of 1 frame of SSR data.

2. The following spacecraft/instrument events occurred during this week. The Ahead observatory operated nominally during this week.

- The average daily science data return for Ahead was 5.8 Gbits during this week.

STEREO Behind (STB) Status:

1. The following Ground System anomalies/events occurred during this reporting period:

- None.

2. Behind Observatory Status - Low main bus voltage and battery slowly charging, 2 (#6 & 9) out of 11 battery cells are currently not functioning, uncontrolled attitude, rotating about the principal axis of inertia. Current orientation supports some solar array input, usable uplink communication near the edge of the + Z LGA, and only carrier lock on the downlink. Propulsion tanks and lines are being warmed but suspect they remain frozen. System momentum level requires use of the thrusters to re-establish attitude control. The IEM (avionics) is on, PDU 1553 bus is on, propulsion primary tank heaters are on, propulsion primary line internal heaters are on, and propulsion primary line and valve external heaters are on. The battery charge rate is C/4. A spacecraft emergency remains in effect. Detailed status of the recovery activities to restore operations from the Behind loss of communication anomaly, which occurred on October 1, 2014, are listed below.

- On day 242, the DSN was able to extract 5 additional telemetry frames from Friday's IEM power on. These frames are being processed and the telemetry from the 5 critical packets will be distributed. An updated recovery plan was developed and discussed during the daily telecon. Tomorrow, carrier recovery will be commanded, attempting to power on the TWTA. If the downlink signal is detected, the TWTA on time will be limited to ~21 minutes, which is 1.5 times the period of the beat frequency of rotation and nutation. The reaction wheel latching relays will be commanded off. If no signal is detected, the battery recovery commands will be sent for the remainder of the support and the next day's support will be shortened to 4 hours. This operational cadence will continue until BEHIND is restored to active attitude control or the DSS-63 time ends on Sep 11<sup>th</sup>.

- On day 243, the DSN once again detected the downlink carrier signal at 1321z from STEREO BEHIND. The signal was intermittent with a peak level of -159 dBm. FDF analysis of the Doppler residuals shows the signal fluctuating at ~140 seconds and a spin-axis to Earth angle of ~36 degrees. Note that the TWTA was only on for 30 minutes to conserve battery state of charge. A more stable uplink is required to load parameters necessary for conducting an autonomous momentum dump to re-establish attitude control. From Friday's IEM power on, four additional telemetry packets were processed (one was a duplicate) and will be distributed. The reaction wheel latching relays were commanded off along with all unnecessary power loads. Note that the updated ephemeris for BEHIND has a predicted error of 40,000 km, not 2200 km, which the DSN began using on Saturday, Aug 27th. Propulsion tank warming durations were revised based on 21.5 kg per tank
- On day 244, while testing the effect on the carrier signal of the uplink optimization, unexpectedly 5 telemetry frames were received as the IEM was on for 22 hours. With a good signal level, -159 to -164 dBm and a ~3 minute period, there was continuous communications with the TWTA on for 30 minutes. Subsequent analysis showed that the telemetry from the PDU was stale, so there was no sun vector. From the one sample, the battery appears to be charging with the TWTA on, with battery pressures 634 psi and 19 psi, and main bus voltage at 24.9v. As the uplink was good, began loading uplink time consuming commands to EEPROM, i.e., autoexec macro 1 and bad gyro data parameter to EA and G&C. The S/C emergency was reinstated (had ended at midnight) and a 6.2 hour DSS-14 support was added starting at 1815z. As the signal had sufficient margin, the downlink rate was increased to 35 bps, which provides one (1 packet/frame) every 102 seconds. 8 good telemetry frames were received, including 3 memory dump packets and one temperature packet. Despite suspending fault protection and power off all unnecessary loads, it was found that many heaters and the star tracker were on. These were subsequently powered off and disabled fault protection. The 3 loads to EEPROM were verified from dumps received. This additional track was extremely beneficial. To allow the battery to charge, the PDU 1553 bus was powered off and the propulsion tank secondary heater was enabled.
- On day 245, during 4 brief TWTA sampling periods this morning, communications are still continuous with the

carrier signal fluctuating between -158 dBm and -164 dBm. The battery charge rate increased to C/4 for approximately 4 hours during the track this morning increasing the battery pressure by ~50 psi. An autonomous momentum dump parameter was loaded, dumped, and verified to EA RAM and EEPROM and G&C EEPROM. Detailed power subsystem telemetry was received and cell #6 and #9 (2 out of 11 cells) are indicating 0 volts. Propulsion tanks are slowly warming and have increased by ~2 deg C. IMU2 was powered on briefly and initial indications show that it is healthy and was used to confirm the estimated system momentum level (high). 54 telemetry packets were received. From the Doppler data analysis by the FDF, the nutation is slowing and returning to the previous spin axis orientation. Subsequently, it was noticed from telemetry analysis that the catalyst bed heaters and propulsion line & valve heaters were on. A 1.75 hour DSS-14 support was added at 2255z during which commands were sent to power off all unwanted loads in the blind.

- On day 246, during 2 brief TWTA sampling periods this morning, communications are still continuous with the carrier signal fluctuating between -158 dBm and -168 dBm. The battery charge rate increased to C/4 for approximately 6.5 hours during the track this morning increasing the battery pressure by ~120 psi. Propulsion tanks are slowly warming and tank 1 increased by ~8 deg C and tank 2 increased by ~10 deg. In preparation for the autonomous momentum dump to re-establish attitude control and Sun pointing, momentum dump limit parameters were loaded, dumped, and verified to EA RAM and EEPROM. 41 telemetry packets were received including samples of voltages and currents. Also, power switching cards 0, 1, and 4 were powered on and all unwanted loads power off. The nutation is slowing and returning to the previous spin axis orientation. Post track, after power analysis, it was concluded that the battery could support both propulsion tank heaters on. The secondary propulsion tank heater will be powered off when the TWTA is on. As the propulsion tanks are still frozen, a 2.75 hour DSS-14 support was added at 2020z to power on the primary propulsion tank heater and powered on power switching cards 1 and 3. As fault protection is disabled in EA mode, all power switching cards are now on which is the nominal configuration. The spacecraft ephemerides, spanning 113 days from Sep 1st through Dec 22nd, were loaded to G&C EEPROM1 and 2. The plan for re-establishing attitude

control and Sun pointing on by conducting an autonomous momentum dump in EA mode, powering on reaction wheels, and promoting the observatory to Standby mode was completed. The procedure is being developed and tested.

- On day 247, during 3 brief TWTA sampling periods this morning, peak carrier signals were -158 dBm, however, loss of symbol lock occurred during trough of 2 of the 7 cycles in the period. The nutation continues to decrease and returning to the previous spin axis orientation. 49 telemetry packets were received along with 19 bad frames. The battery charge rate increased to C/4 for approximately 6.5 hours during the track this morning increasing the battery pressure by ~85 psi. In 18 hours, propulsion tanks continued to warm and tank 1 increased by ~1 deg C and tank 2 increased by ~6 deg C. Tank pressures are still indicating zero. In preparation for the autonomous momentum dump to re-establish attitude control and Sun pointing, UTCF was set in EA RAM, HGA angle bias to zero, and Earth ephemerides were loaded, dumped, and verified. The plan for re-establishing attitude control and Sun pointing on by conducting an autonomous momentum dump in EA mode was reviewed during the telecon. The procedure is being developed and tested on the hardware simulator.
- On day 248, during 3 brief TWTA sampling periods this morning, peak carrier signals were -158 dBm, however, loss of symbol lock occurred during troughs of 3 of the 7 cycles in the period. The nutation continues to decrease and returning to the previous spin axis orientation. From the limited telemetry received, the uplink CLA data was analyzed and there appears to be sufficient uplink margin for the time being, though data does show a slight downward trend. 25 telemetry packets were received along with 30 bad frames while downlinking at 35 bps. The battery charge rate increased to C/3 for approximately 3 hours during the track this morning increasing the battery pressure by ~140 psi. In 18 hours, propulsion tanks appear to have leveled off with the secondary tank heater on continuously. Tank pressures are still indicating zero. Near the end the track, the battery charge rate was set to C/4 and the both propulsion tank heaters, both propulsion internal line heaters, and the PDU 1553 were left on. In preparation for the autonomous momentum dump to re-establish attitude control and Sun pointing, UTCF was set in C&DH EEPROM, battery PPT parameters, and C&DH storage variable and macros for Standby mode were loaded, dumped, and verified.

With the degraded battery (2 out of 11 cells not functioning), to monitor battery performance with 4 heaters on to thaw the hydrazine, a 2 hour DSS-43 support was added at 2100z. Battery performance was slightly better. After 6 hours with both propulsion tank heaters on, tank 1 increased 5 degrees C and tank 2 by 3 degrees C. The trough of the downlink signal was 10 dB higher than earlier and symbol lock was maintained throughout the 30 minute downlink. 17 additional telemetry packets received. The procedure for re-establishing attitude control and Sun pointing by conducting an autonomous momentum dump in EA mode has been developed and is being tested on the hardware simulator.